Ooops – WalMart Strikes Back

- A Minivan crashed in the Walmart parking lot running into the garden center at ~ 10 mph. There are 2 patients in the vehicle both children.
- 1 has had an apparent Seizure -
- 1 has a painful traumatic injury -

As the Medical Director:

- Have I adequately trained my paramedics to respond appropriately?
- Is there any Evidence to guide me in Directing my service?
- What are the Barriers to providing my staff all of the opportunities that they need to take excellent care of our community?

Pre-Hospital Pediatrics: Is there any evidence out there?

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Obligatory Disclosure Slide

- There are no relevant financial relationships to disclose
- The content of this lecture was developed following an extensive literature search and is the most up to date, evidence-based information available

What I will be covering:

- Paramedics Comfort and Needs as they relate to Pediatric patients
- General Weakness in Patient care and Paramedic Education
- Identified Areas of Research and Study
- 2 In Depth Studies with Guidelines
  - Seizures and Pain Management
  - NOT – C-Spine or Airway
- Disaster Planning

Peds Stats

- 3 million Peds cared for by EMS annually
  - 48% ALS
  - 53% male
  - Avg Age 9.6 yrs
- Common complaints
  - Trauma – 28%
  - General Illness – 10%
  - Respiratory Distress – 9%
  - Seizure - 9%
  - Airway Obstr. - 1%
  - Cardiac Arrest 0.8%

Lerner, B et al.,"Characteristics of the Pediatric Patients Treated by the Pediatric Emergency Care Applied Research Network's Affiliated EMS Agencies." *Prehospital Emergency Care* 18.1 (2014): 52-59

Pediatric Specific Problems

- Paramedic Familiarity
- Stressful
- Medication Administrations
- Fear of Doing Harm

Pediatric Familiarity

- 313 EMS providers in a large Urban Detroit System
- Any Guesses as to the number of transport (%)
  - <10% pediatric transports

Stressful

- Pretty obvious
- Generally a sudden change in a previously healthy child
- Highly Emotional Scenes
- Time Pressures
- Parents or Caregivers are stressed and influence scene emotions
- Often traumatic – sometimes NAT

General Comfort Levels

- 3.1 out of 5
- Specific Fears
  - 1. Airway
  - 2. Trauma Management
  - 3. Seizures
  - 6. Pain Management
  - 11. Medication dosing

Additional Training

- Paramedic Identified Needs
  - 1. Airway
  - 2. Neonatal Resuscitation
  - 3. Respiratory illnesses
  - 4. Pain Assessment
  - 5. Cardiac Arrest
  - 6. Trauma
  - 7. Shock
  - 8. Medication Dosing
  - 9. Seizures
  - 14. IVs

Want v. Need

- Our Perceptual Need is Opposite of out Actual Need
- Airway #1 but ~ 1% of patients! !
- Trauma - 1/3 of runs!
- Medications
  - Consistently lowest 1/3 of priorities

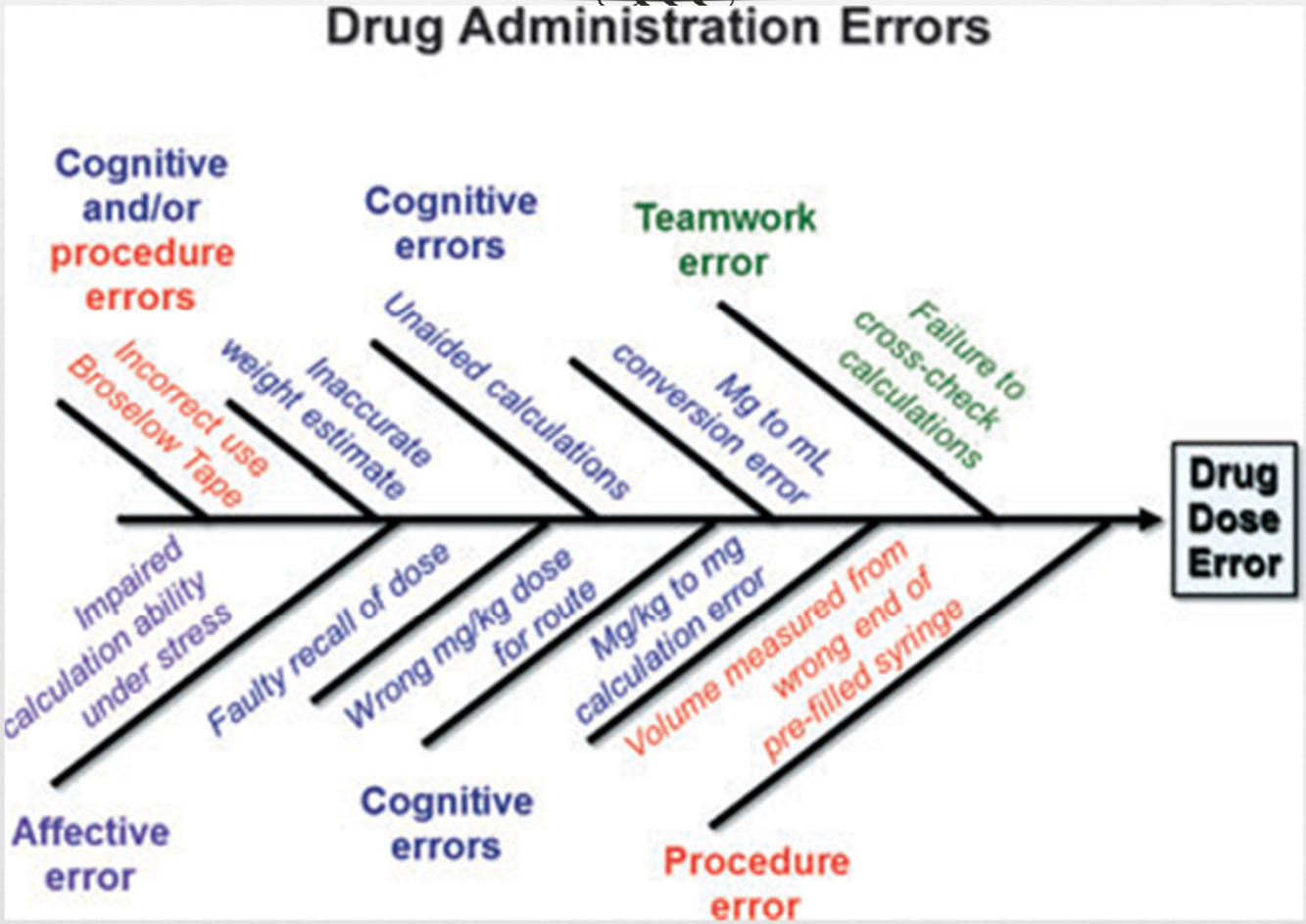
Medications!

- Arguably the key to all ALS peds care
- MOST dangerous intervention in all of Pediatrics
- Fraught with Errors
  - Needs calculation (MATH!)
  - Small doses or volumes
  - Weight based
- Unfamiliar usage in children

Medication Errors

- Incorrect Wt. estimate
- Difficulty with Calculations under stress
- Conversions
- Failure to double check
- Incorrect usage of Aids

Root Causes of Error in Simulator Setting



Lammers, R Mdet al. "Root Causes of Errors in a Simulated Prehospital Pediatric Emergency"ACADEMIC EMERGENCY MEDICINE • January 2012, Vol. 19, No. 1 •

- 46 – 60% Error based on drug or dose
- Protocols Call for different doses based on routes of Delivery
- Unfamiliar delivery devices
  - Reverse graduated syringes

Calculations

- MATH – Need I say more?
- Fine Motor Skill Lost under Stress
- Conversions
  - mg/kg →
  - mg total dose→
  - X drug conc. mg/ml→
  - ml volume delivered to pt
- Inaccuracies at ANY one of these steps can be catastrophic!

Medication Errors

- Failure to double check
  - Dosages (mg/kg)
  - Partner
- Incorrect usage of Aids
  - Reading Broselow wrong

Weight Based Medications

- Very few adult patients get wt. based meds
- Self selected as the sickest patients!
  - Seizures
  - Cardiac Arrest
  - Respiratory Distress
  - Trauma
  - Asthma
  - AMS
  - Allergic Reactions

Accuracy of Weight Est.

- How Accurate do you think our medics are????
  - (+/- 20%)
- Children <10yrs old
  - 34% (68/199 tested)
- Older than 10
  - 48% (96/199)
- Seizing –
  - 23%!

Fear of Doing Harm

- Overall Preference to Defer
  - Low Self confidence in Pediatric specific actions
- No Harm (Tx) = No Foul
- Fear of Repercussions
  - Error Potential Higher
  - Supervisors
  - Medical Control
  - Receiving Institution

IV Starts

- <2% of Emergent Responses
- 88% overall Success
- 64% under 2 yo
- 53% had multiple attempts
- Age Biggest influence
  - Each 1 year increase associated with an 11% increase in Odds of success.

Prehospital Peripheral IV access success Rates in Children, PEC. 2013 Oct-Dec:17 (4):425-8

Preventing Medication Errors

- Raising Awareness of the Problem!
- Training
  - Initial Cert, In-service, Protocol testing
  - Short term fix for a perishable skill
- Standardized and Unambiguous Labels
- Setting a standardized dose across a range of weights
  - Albuterol, Zofran etc
- Drug Dilution
  - 1:1 dosing

- Weight Based Rulers – Broselow
  - Have their own inherent errors
- Reference Aids
  - Apps
  - Drug Calc Cards
  - Weight Based Tables
- Paramedics perform better in standardized testing when allowed to use a training aid – drug card
  - 94% accurate with card – 10X error – 0.7%
  - 65% accurate without – 10X error – 6.2% !!!
  - (23% ETT w/o card)

Summary

- Paramedics Lack Confidence when it comes to Peds
- First Do No Harm May Impede Intervention
- Medications Are the Key and Liability
  - Provide Education Frequently – Perishable Skills
  - Use Supplemental Aids where possible
  - Use Simplified Dosage Protocols where possible.

PECARN Statement –

- *Although we have 35 years of experience with prehospital care in the US, there is limited research specific to pediatric prehospital care consequently very little care is evidence based*

Not a new concept

- National Prehospital Evidence-based Guideline Model Process
  - 2006 IOM Report “the Future of Emergency Care in the United States Health System” – “Emergency Medical Services: At the Crossroads”
  - Recommends NHTSA in Partnership with professional Orgs “
  - NHTSA and EMSC

- 2008 – FICEMS Federal Interagency Committee on EMS and NEMSAC sponsored first conference
  - EMS Stakeholders,
  - International Experts in EMS
  - SMEs
  - Developed the draft model process for EBM EMS guidelines
- 2009 – NHTSA and EMSC Nat'l Resource Ctr
  - Beta Test topics: Helicopter Transport, Peds Seizures, Pain Mgmt in Trauma
- 2014 First Guidelines were presented

Research Priorities

- PECARN Peds Prehospital Research Summit 2007 Atlanta GA
  - 22 hospitals
  - 42 participants – 26 Pysicians
  - 20 PECARN Reps
  - 9 EMS Agencies
  - 13 SMEs
- 42 topics studied
  - Pain Mgmt most widely discussed

Clinical Topics

- 1 Airway management
- 2 Respiratory distress
- 3 Trauma
- 4 Asthma
- 5 Head trauma
- 6 Shock
- 7 Pain
- 8 Seizures
- 9 Respiratory arrest
- 10 C-spine immobilization
- 11 Cardiac arrest
- 12 Injury prevention
- 13 Children with special needs
- 14 Poisoning
- 15 Abuse and neglect

System Topics

- 1 Effectiveness of out-of-hospital interventions
- 2 Knowledge and skill deterioration
- 3 Patient outcomes
- 4 Evaluation of the impact of overall EMS system changes on children
- 5 Training effectiveness

Problems with PreHospital EBM

- Labor Intensive
- Needs to be multi-disciplinary
- Needs to support a national strategy to gain momentum and acceptance
- General lack of Strong Evidence

Case Continues Pt 1

- In the MiniVan was Levi, an 18 month old male with cold for 1 day. He had recently woke from a nap and ate poorly at lunch. Just prior to the accident mom noticed his eyes roll into the back of his head and he fell to the ground twitching and convulsing to all extremities.
- Paramedics arrive and find child post-ictal and begin primary assessment
- What do they do and why?
- What's the evidence that it will help?

Pediatric Seizures

- High Incidence
  - 4-6% of all children under age 16
  - 15-25% of EMS runs
- Potential morbidity
  - Initial Stress Response
  - Chronic Sz D/O
  - Hypotension, Anoxia, Encephalopathy, Hyperthemia, Pulomary Edema, Cardiovascular Collapse,
  - Age of child, etiology of seizure and duration correlate with poor outcomes

- Difficult patients to manage
  - Provider variability or limited knowledge
- High stress
- Limited Pediatric Data – extensive adult literature
- Most sz's will cease spontaneously or with first line medication – Benzo
- Spontaneous cessation becomes less likely after 5 minutes
- Response to anticonvulsants decreases with sz duration

- Wide Variability in Protocols and Management across the country
  - Interventions
  - Medications
  - Levels of response
  - Airway Management
- Definition of Status?
  - >30min
  - No return to baseline prior to re-seizing?
  - If the child is still seizing on EMS arrival = tx as status

Basic Management

- Cessation of Seizure Activity
- Preventing Seizure Recurrence
- Identify Cause
- Prevention of Further Injury
- Airway Protection
  - O2, Suction, BVM, etc.

An Evidence-based Guideline for Pediatric Prehospital Seizure Management Using GRADE Technology

- Goal to promote timely seizure cessation while avoiding respiratory depression and seizure recurrence
- Prompt Transport and minimal scene time
- Minimizing cost to EMS agencies
- GRADE Techonology
  - Evaluates Evidence Available
  - 5 strong recs
  - 10 Weak recs

Glucometry

- All Patients in Status should be assessed for Hypoglycemia
  - Evidence – V. Low
  - Rec.- Weak
- Hypoglycemia Should be treated (Gluc <60)
  - Evidence – Weak
  - Rec. - Strong

IV Access

- IV Placement is NOT necessary if transport time is "short"
  - Evidence – Low
  - Rec - Strong

IV v. Non-IV Meds

- Recommend that protocols utilize or have provisions for Non-IV routes of medications
  - Evidence – Moderate
  - Rec. - Strong

Non-IV v. Non-IV Meds

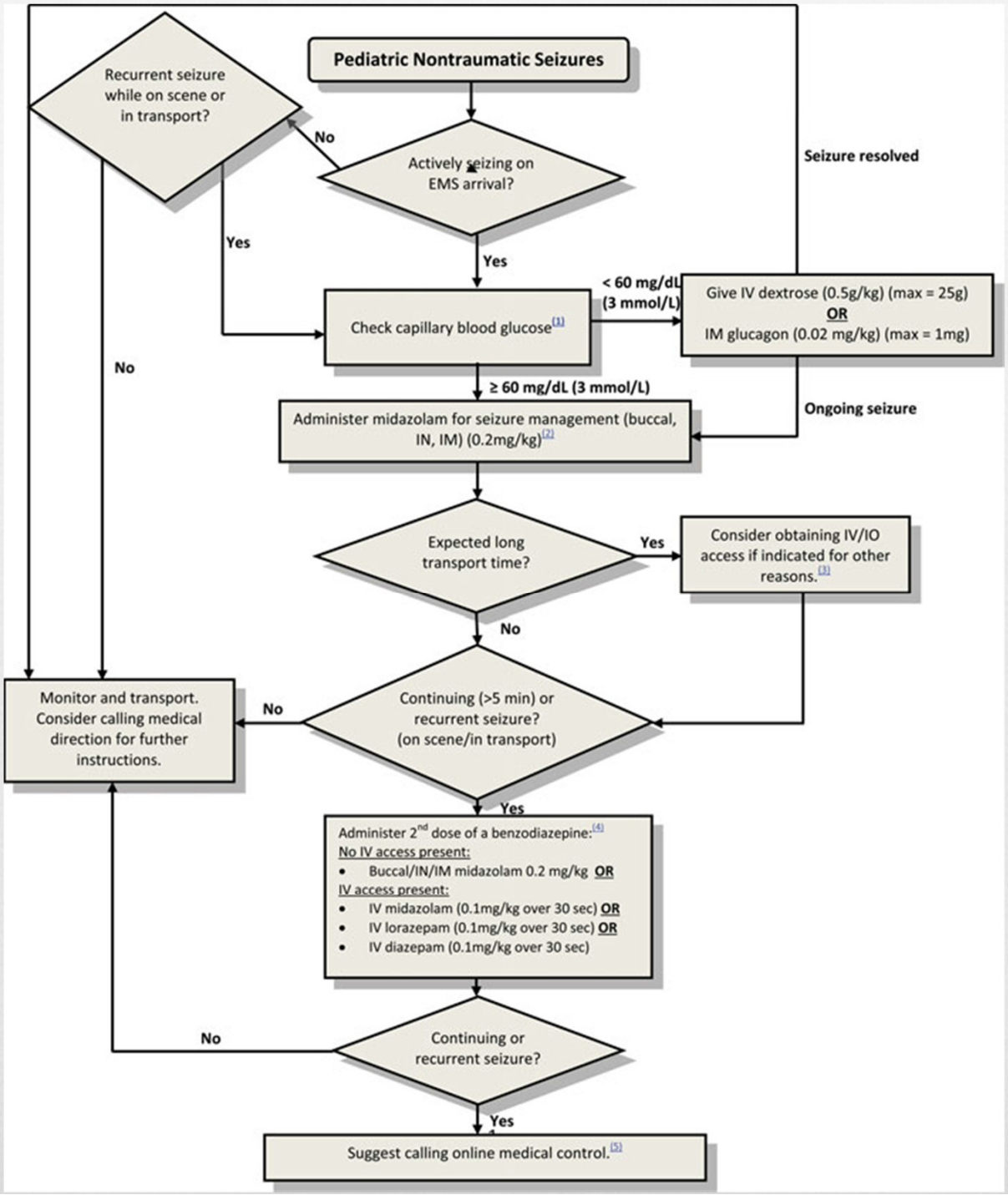
- Buccal Midazolam OVER Rectal Diazepam
  - Evidence – Low
  - Rec. – Strong
- IM Midazolam OVER Rectal Diazepam
  - Evidence – Very Low
  - Rec. – Weak
- IN Midazolam OVER Rectal Diazepam
  - Evidence – Very Low
  - Rec. - Weak

IV v. IV Meds

- IV Diazepam, Midazolam or Lorazepam are EQUIVALENT Therapeutic options
  - Evidence – Very Low
  - Rec. – Weak
- Diazepam 0.05-0.1mg/kg IVP
- Lorzepam 0.05-0.1mg/kg Slow IVP
- Midazolam 0.1mg/kg IVP

Medical Direction

- In patients in Status Epilepticus trained prehospital personnel should be allowed to administer medications without online medical control
  - Evidence – Very Low
  - Rec. - Weak


Pediatric Nontraumatic Seizures
Recurrent seizure while on scene or in transport?
No
Actively seizing on EMS arrival?
Seizure resolved
Yes
Yes
< 60 mg/dL (3 mmol/L)
Check capillary blood glucose[1]
Give IV dextrose (0.5g/kg) (max = 25g)
OR
IM glucagon (0.02 mg/kg) (max = 1mg)
No
≥ 60 mg/dL (3 mmol/L)
Ongoing seizure
Administer midazolam for seizure management (buccal, IN, IM) (0.2mg/kg)[2]
Expected long transport time?
Yes
Consider obtaining IV/IO access if indicated for other reasons.[3]
No
Monitor and transport. Consider calling medical direction for further instructions.
No
Continuing (>5 min) or recurrent seizure? (on scene/in transport)
Yes
Administer 2nd dose of a benzodiazepine:[4]
No IV access present:
• Buccal/IN/IM midazolam 0.2 mg/kg OR
IV access present:
• IV midazolam (0.1mg/kg over 30 sec) OR
• IV lorazepam (0.1mg/kg over 30 sec) OR
• IV diazepam (0.1mg/kg over 30 sec)
No
Continuing or recurrent seizure?
Yes
Suggest calling online medical control.[5]

Add'l Seizure Data

- Multiple Studies Support Intranasal Midazolam over PR Diazepam
  - Excellent Bioavailability
  - Avoids first pass metabolism (v. PR Diazepam)
  - Low incident Resp Depression
  - Significant Cost savings
    - $16 v. $330 for PR Diazepam
  - Ease of Use
  - No Fears of "Inappropriate contact"

Seizure Summary

- Check and Treat Low Glucose
- Provide Multiple Options to Treat Status
  - IV un-necessary initially
- PR Diazepam is Out
- Medical Control Should be Implied

Patient 2

- Sitting across from the seizing child was a 6 yo girl. At the time of the accident she was climbing over the seat to hit her brother for stealing her animal crackers. On impact she was thrown into the front seat. She is now complaining of pain to her R arm with an obvious deformity. No other trauma noted through the Cheetos stains and tears.
- How would your medics treat her?
- Anything for her owies?

Pain Management

- Painful Complaints “Trauma” and “Pain” 2 of the top 3 EMS calls
  - ~37% of runs
  - Up to 67% as intense to severe (>4 or >7)
- Prehopsital pain management has been shown to provide up to 90% relief
- 85% of pediatric patients with documented pain received no intervention!

Barriers and Enablers for Prehospital Analgesia for Pediatric Patients

- Perceived ability to assess pain
- Knowledge deficits in pain management
- Vascular access
- Comfort with medications
- Difficulty distinguishing between pain and anxiety

OVERALL PREFERENCE TO DEFER

Behavioral Beliefs

- How the paramedic feels regarding pain control "Attitude"
  - Believed pain as unimportant – No my job
  - Concern for unknown allergies
  - Concern for resp depression
  - Benefit of pain control not worth risk of OD

Normative Beliefs

- Paramedic expectations of beliefs held by supervisors – "Subjective norms"
  - Negative response from ED staff
  - "" "" "" Supervisors
  - Weakness with didactics
  - Learned to defer pain control if possible –
- "So that the ED could see that they were really in pain"

Control Beliefs

- Paramedic beliefs of “perceived behavioral controls”
  - Unfamiliarity with Peds
  - IV Access
  - Unfamiliar with Pediatric Protocols

Enablers

- Paramedic Familiarity and Education
- Commercially available guides
- Good relationship with online control

Past Performance …

- Prior experience was very influential
- Parent interaction/anxiety
- Unwanted attention from supervisors
  - Fear if punishment or potential error
  - Errors of omission
- Prior bad interaction with online medical control
- ED Nurse chastised medic

System Barriers

- Medication Limits
  - Morphing requires IV
- Device Limits
  - Purchasing and teaching use of MAD
- System Oversight
  - Some systems require online Medical Control for analgesia
  - Record keeping/data collection and CQI

Pain Medications in Use

- Morphine, Ketamine, Fentanyl, Methoxyflurane, Tramadol, NO2, Nubain, Toradol
- Morphine IV and Fentanyl IN most widely studied
- MAD increases ease of route but does not seem to increase usage of medications
- Standard Dosing
  - Fentanyl 1-2 mCg/kg (up to 4 IN)
  - Morphine 0.1mg/kg IV

"An Evidenced-Based Guideline for Prehospital Analgesia in Truama"

- Assess pain as part of general care
- Consider all patients with acute traumatic pain as candidates for analgesia regardless of transport interval
- Use an age- appropriate pain scale to assess pain
  - <4yrs - FLACC or CHEOPS
  - 4-12yrs – Self Reported Faces Pain Scale
  - >12yrs - Numeric Rating Scale 1-10
- Use Narcotic analgesics for patients in moderate to severe pain – Morphine or Fentanyl

Cont.

- Relative Contra-Indications
  - GCS<15
  - Hypotension
  - Hypoxia
  - Hypoventilation
  - Condition preventing administration
    - No IV/IO, Blocked Nasal passages
- Reassess all patients receiving medication q5min
- Redose if still in significant pain
  - Redose at ½ intial dose

Further Research

- Prehospital Friendly Pain Assessment tools
- Treatment of pain in altered or congnitive impairment
- Children with special needs
- Additional Agents (Ketamine)
- Optimal Dose/Redose
- Oral Analgesics
- Removing Barriers to Weight Based Dosing Charts
- Access to protocols

- *"RESPONSIBILITY TO CHANGE THE BELIEF STRUCTURE REGARDING PEDIATRIC PAIN MANAGEMENT LIES NOT WITH THE PARAMEDIC, BUT WITH PHYSICIANS, HOSPITAL STAFF AND PARAMEDIC SUPERVISORS"*

Disaster Planning

- Disasters and MCIs frequently involve whole families including children and special needs clients.
  - 13% of MCI Plans include Pediatrics
  - Most are based on adult protocols
  - Regional Pediatric Centers
- Disaster planning must include these special populations

- Pediatric Specifics
  - Equipment concerns
  - Dietary concerns
  - Huddling of families
  - Patient Identification and Re-Unification
- Triage Protocols
  - JumpSTART –
    - Allows for 5 rescue breaths in Apneic pts
    - AVPU for LOC

Questions

- Any Questions about the Protocols or the Info?

SUMMARY

- Prehospital Guidelines can be based on Best Evidence
  - Time and Resource intensive
  - Regional or State Standards
- Pediatric Seizures
  - Basic Care is key
  - Multiple routes available for medication administration
- Pain Can be Treated Safely by Paramedics
  - Change in Culture is necessary to positively re-enforce these behaviours
- Don’t Forget the Kiddos in Your Disaster Planning

- *“The Road from evidence to practice certainly portends a marathon and not a sprint, but having successfully started down the path as represented by these articles is an excellent place to be”*